tion relative to investigations to be inaugurated and the methods of making them in the Hygienic Laboratory. This board consists of 9 members, 4 of whom are officers of the Government, the remaining 5 being scientists eminent in laboratory work and connected with the leading endowed institutions of the country. By this means the service is brought in touch with the great scientific laboratories, and may avail itself of advice from the highest sources.

Congress has thus made provision for councils in respect to both administrative and scientific matters. Their utilization in the highest degree is one of the most important means of development of public-health organization and public-health work.

The foundations have been laid for further development and for the performance of a greater amount of efficient sanitary work. In order that health administration shall be effective, however, it must be adequately supported by appropriations, and it is the securing of these and their wise expenditure that constitute efficient administration.

HOOKWORM DISEASE.

NUMBER OF TREATMENTS AND NUMBER OF FULL DOSES OF THYMOL ADMINISTERED IN 61 HOSPITAL AND 22 HOME-CURED CASES OF HOOKWORM INFECTION.[1]

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In this paper the term "cured" means that a week or more after treatment a microscopic reexamination of the patient gave negative results.

In practical hookworm-eradication work the question is frequently asked, "How long does it take to cure a case?" This question has a practical basis from the standpoint of the patients, for many of them refuse to take a second course of medication. From the standpoint of the person giving the treatment the question has a double significance: (1) The greater the number of patients who can be cured in a single treatment the more rapidly will a certain—and a very important—part of the work be finished. (2) Many patients are, however, very ignorant and can not be relied upon—as experience shows—to carry out directions; accordingly, the clinician has his choice between (*a*) assuming a certain amount of risk by giving a larger dose, and (*b*) giving repeated treatments with smaller doses, thus giving to himself and to the patient a greater amount of trouble but at the same time increasing the factor of safety for his patient; running the risk, however, that his patient will not return for more than one treatment, and therefore possibly leaving one more uncured case at large to infect other people.

[1] Read at the XVth International Congress on Hygiene and Demography, Washington, September, 1912.
[2] With North Carolina State Board of Health since June 1, 1912.

There are known to us not less than 11 deaths in this country, due, so far as it has been possible to determine, either to following thymol with castor oil instead of with salts, or to carelessness in respect to following out the usually adopted procedure. But whatever the explanation of these deaths may be, the fact remains that many patients whom we treat are exceedingly ignorant and illiterate and are unreliable when it comes to following out instructions.

It is therefore more than an academic matter to determine how small a dose can cure or does cure a case of hookworm infection, and the extent of the infection in question.

The present paper contains two series of cases—one series treated in the hospital, the other at home.

In a certain cotton-mill village in eastern North Carolina, 267 inhabitants (140 males, 127 females) out of a population of 700 volunteered for microscopic examination. Thus 38.1 per cent of the population volunteered.

Of these 267 (white) inhabitants, 140 persons (or 52.4 per cent) were found infected with hookworms.

Of 140 males, 79 persons (or 56.4 per cent) and of 127 females, 61 persons (or 48 per cent) showed hookworm infection.

Most of the patients mentioned in this paper came from the cotton mill in question

Number of treatments of females.—A number of the females were treated at their homes, with a mill nurse to visit them during the day of medication. In some instances it was impossible to obtain specimens to determine whether or not the treatment was complete in results, but the following data may be reported:

Total number of females examined, 127; found infected, 61 persons, or 48 per cent; treated, 52; cured, 19; data incomplete in 33; not treated, 9.

Treated 1 or more times, 52; cured in 1 treatment, 12; not cured in 1 treatment, 21; data incomplete in 19.

Treated 2 or more times, 21; cured in 2 treatments, 7; not cured in 2 treatments, 5; data incomplete in 9.

Treated 3 or more times, 5; cured in 3 treatments, ?; not cured in 3 treatments, 1; data incomplete in 4.

Treated 4 times, 1; data incomplete.

Number of treatments of males.—The following tabulation gives the male cases treated at the hospital and also [in brackets] male cases treated at home.

Treated 1 or more times, 94 [+9]; cured in 1 treatment, 45 [+3]; not cured in 1 treatment, 15 [+1]; data incomplete in 34 [+5].

Treated 2 or more times, 29 [+1]; cured in 2 treatments, 6; not cured in 2 treatments, 14 [+1]; data incomplete in 9.

Treated 3 or more times, 14 [+1]; cured in 3 treatments, 6; not cured in 3 treatments, 6 [+1]; data incomplete in 2.

Treated 4 or more times, 6 [+1]; cured in 4 treatments, 1; not cured in 4 treatments, 5 [1].

Treated 5 or more times, 5 [+1]; cured in 5 treatments, 1; not cured in 5 treatments, 3 [+1]; data incomplete in 1.

Treated 6 or more times, 3 [+1]; cured in 6 treatments, 0; not cured in 6 treatments, 2 [+1]; data incomplete in 1.

Treated 7 or more times, 2 [+1]; cured in 7 treatments, 2; not cured in 7 treatments, [1].

Comparing the male hospital cases with the male home cases and the female (home) cases, it is clear that a greater proportion (45 in 94 equal 47.8 per cent) of cures on 1 treatment are known for the hospital than for the home cases (15 in 61 equal 24.5 per cent). That this result is not due entirely to incomplete data is rendered probable by two facts: (1) That there is a smaller number of known incomplete cures in 1 treatment (15 in 94 equal 15.9 per cent) for the hospital than for the home cases (22 in 61 equal 36 per cent), and (2) in leaving thymol at the home the tendency in all cases is to leave smaller doses so as to increase the factor of safety to the patient, in view of the risks necessarily connected with leaving the drug among people who can not be relied upon to carry out directions, even when printed directions are given. In other words, a larger dose of thymol given under hospital conditions involves less of a risk to a patient in a given physical condition than it does to the same patient at home, and we are fully justified in giving larger doses in hospital practice.

Total size of dose used.—Tabulation of the cured cases in question, according to the total amount of thymol used per age of patient gives the following results:

Tabulation of 19 cured female cases, treated at home.

Age.	No.	Basic maximum single dose of thymol.	First dose.	Second dose.	Total dose of thymol.	Portion of single basic maximum dose for age.
		Grains.	*Grains.*	*Grains.*	*Grains.*	
7½ years	1	15	5	5	10	0.66
12 years	1	30	10	.....	10	.33
12½ years	1	30	12½	.....	12.5	.41
13 years	1	30	15	.....	15	.50
15 years	2	45	20	.....	20	.44
16 years	1	45	12½	12½	25	.55
Do	1	45	30	30	60	1.33
17 years	1	45	25	.....	25	.55
18 years	1	45	40	.....	40	.88
Do	1	45	35	35	70	1.55
19 years	1	45	35	.....	35	.77
20 years	1	60	35	.....	35	.58
21 years	1	60	40	40	80	1.33
22 years	1	60	50	.....	50	.83
23 years	1	60	40	40	80	1.33
25 years	1	60	45	45	90	1.50
26 years	1	60	30	.....	30	.50
45 years	1	60	30	.....	30	.50
Total	19	825	.....	.....	717.5	.87

From the foregoing tabulation it is seen that of 19 complete cures in home treatment, 12 had only one treatment and 7 had two treatments each; 14 were cured with less than a full dose of thymol, and 5 had above one full dose, but not over one and one-half full doses.

Illustrating the possibilities of accident, even when the patients are cautioned as to details, it may be stated that a few moments after one of the children took her thymol, some kind neighbor learning that the child had had no breakfast attempted to give to the patient some wine. It was only by a mere chance that the good intentions of the kind neighbor were frustrated, and thereby that probable accident was avoided.

Although it was not feasible to draw a comparison in these cases between the size of the dose and the number of worms passed, the table shows that some cases may be cured at home in one course of treatment with even as low as one-third of the present standard dose.

Tabulation of three cured male cases treated at home.

Age.	Number.	Basic maximum single dose of thymol.	First dose.	Total thymol given.	Portion of single maximum dose given.
		Grains.	*Grains.*	*Grains.*	
5 years	1	15	3	3	0.2
6 years	1	15	5	5	.33
7 years	1	15	7½	7½	.5
Total	3	45	15½	15½	.34

In case of these children it was distinctly unwise to give the maximum dose for the age group, and all three were cured with half a dose or less. In one other case, seven home doses (small) failed to effect a complete cure.

It was not feasible to count the worms in these cases.

Tabulation of 61 cured hospital male cases, arranged according to age and dose.

Age.	No.	Basic maximum dose.	First dose.	Second dose.	Third dose.	Fourth dose.	Fifth dose.	Sixth dose.	Seventh dose.	Total thymol.	Portion of single maximum dose given.	Worms collected.
		Grains.	*Grains.*	*Grains.*	*Grains.*	*Grains.*	*Grains.*	*Grains.*	*Grains.*	*Grains.*		
5 years	1	15	7.5	.....	.....	.....	.....	.....	.....	7.5	0.5	1
Do	1	15	10	10	.....	.....	.....	.....	.....	20	1.33	14
6 years	1	15	7.5	10	10	.....	.....	.....	.....	27.5	1.83	62
7 years	1	15	15	.....	.....	.....	.....	.....	.....	15	1	2
Do	1	15	15	.....	.....	.....	.....	.....	.....	15	1	5
8 years	1	15	10	.....	.....	.....	.....	.....	.....	10	.66	42
9 years	1	15	20	.....	.....	.....	.....	.....	.....	20	1.33	2
Do	1	15	20	.....	.....	.....	.....	.....	.....	20	1.33	3
Do	1	15	20	.....	.....	.....	.....	.....	.....	20	1.33	7
10 years	1	30	15	.....	.....	.....	.....	.....	.....	15	.5	0
Do	1	30	20	.....	.....	.....	.....	.....	.....	20	.66	1
Do	1	30	20	.....	.....	.....	.....	.....	.....	20	.66	19
Do	1	30	20	20	20	.....	.....	.....	.....	60	2	474
Do	1	30	12	15	12.5	15	20	.....	.....	74.5	2.48	295

Tabulation of 61 cured hospital male cases, arranged according to age and dose—Contd.

Age.	No.	Basic maximum dose.	First dose.	Second dose.	Third dose.	Fourth dose.	Fifth dose.	Sixth dose.	Seventh dose.	Total thymol.	Portion of single maximum dose given.	Worms collected.
		Grains.	*Grains.*	*Grains.*	*Grains.*	*Grains.*	*Grains.*	*Grains.*	*Grains.*	*Grains.*		
11 years..	1	30	15	.....	.....	.....	.....	.....	.....	15	0.5	2
Do....	1	30	25	.....	.....	.....	.....	.....	.....	25	.83	2
Do....	1	30	25	.....	.....	.....	.....	.....	.....	25	.83	4
12 years..	1	30	25	.....	.....	.....	.....	.....	.....	25	.83	21
Do....	1	30	25	.....	.....	.....	.....	.....	.....	25	.83	6
Do....	1	30	30	.....	.....	.....	.....	.....	.....	30	1	7
Do....	1	30	10	10	20	.....	.....	.....	.....	40	1.33	113
Do....	1	30	20	20	.....	.....	.....	.....	.....	40	1.33	68
Do....	1	30	20	20	20	25	25	25	25	160	5.33	506
13 years..	1	30	20	.....	.....	.....	.....	.....	.....	20	.66	138
Do....	1	30	25	.....	.....	.....	.....	.....	.....	25	.83	1
Do....	1	30	25	.....	.....	.....	.....	.....	.....	25	.83	1
Do....	1	30	20	25	.....	.....	.....	.....	.....	45	1.5	111
Do....	1	30	20	20	30	.....	.....	.....	.....	70	2.33	170
14 years..	1	30	20	.....	.....	.....	.....	.....	.....	20	.66	150
Do....	1	30	25	.....	.....	.....	.....	.....	.....	25	.83	0
Do....	1	30	25	.....	.....	.....	.....	.....	.....	25	.83	9
Do....	1	30	30	.....	.....	.....	.....	.....	.....	30	1	4
Do....	1	30	30	.....	.....	.....	.....	.....	.....	30	1	7
Do....	1	30	20	20	25	.....	.....	.....	.....	65	2.16	72
15 years..	1	45	25	25	.....	.....	.....	.....	.....	50	1.11	1,142
16 years..	1	45	20	.....	.....	.....	.....	.....	.....	20	.44	73
Do....	1	45	30	.....	.....	.....	.....	.....	.....	30	.66	3
Do....	1	45	20	25	30	.....	.....	.....	.....	75	2.33	538
Do....	1	45	10	15	25	15	25	30	30	150	3.33	633
17 years..	1	45	25	25	25	25	.....	.....	.....	100	2.22	2,277
18 years..	1	45	45	.....	.....	.....	.....	.....	.....	45	1	(?)
Do....	1	45	50	50	.....	.....	.....	.....	.....	100	2.22	92
19 years..	1	45	45	.....	.....	.....	.....	.....	.....	45	1	37
20 years..	1	60	45	.....	.....	.....	.....	.....	.....	45	.75	11
Do....	1	60	45	.....	.....	.....	.....	.....	.....	45	.75	72
Do....	1	60	50	.....	.....	.....	.....	.....	.....	50	.83	7
21 years..	1	60	60	.....	.....	.....	.....	.....	.....	60	1	95
Do....	1	60	60	.....	.....	.....	.....	.....	.....	60	1	143
23 years..	1	60	60	.....	.....	.....	.....	.....	.....	60	1	167
24 years..	1	60	60	.....	.....	.....	.....	.....	.....	60	1	24
25 years..	1	60	45	.....	.....	.....	.....	.....	.....	45	.75	44
26 years..	1	60	42.5	.....	.....	.....	.....	.....	.....	42.5	.70	6
27 years..	1	60	60	60	.....	.....	.....	.....	.....	120	2	1
29 years..	1	60	60	.....	.....	.....	.....	.....	.....	60	1	80
30 years..	1	60	60	.....	.....	.....	.....	.....	.....	60	1	8
31 years..	1	60	60	.....	.....	.....	.....	.....	.....	60	1	17
33 years..	1	60	50	.....	.....	.....	.....	.....	.....	50	.83	8
36 years..	1	60	50	.....	.....	.....	.....	.....	.....	50	.83	58
37 years..	1	60	60	.....	.....	.....	.....	.....	.....	60	1	97
38 years..	1	60	60	.....	.....	.....	.....	.....	.....	60	1	28
60 years..	1	45	50	.....	.....	.....	.....	.....	.....	50	1.11	6
Total.	61	2,355	.....	.....	.....	.....	.....	.....	.....	2,722	1.15	12,980

From the foregoing table it will be seen that of 61 cured hospital cases in this series 45 received 1 treatment, 6 received 2, 6 received 3, 1 received 4, 1 received 5, and 2 received 7 courses of treatment. If, however, we base the comparison on the standard maximal dose for the age group in question, the following results are obtained: 4 cases were cured with a total of 0.5 of the maximal dose or less; 21 with between 0.5 and the maximal dose, 16 with the maximal dose, 10 with a total dose of between 1 and 2 maximal doses; 8 cases with a total dose of from 2 to 2.48 maximal doses; 1 case was cured with 3.33 maximal doses; and 1 with 5.33 maximal doses; a total of 61 were cured with a total dose averaging 1.15 maximal dose.

Comparing now the 61 hospital with the 22 home cases it is seen that while, from a standpoint of caution, a smaller number of home cases were cured on 1 treatment, the cures in general were effected with smaller sized doses (average 0.84) than those used in the hospital cases (average 1.15).

From the hospital cases it is seen that in the cure of 58 cases 2,637 grains of thymol were used and that from the stools of these patients 12,980 worms were collected. Thus, on an average 1 grain of thymol expelled at least 4.7 worms. This conclusion is not, however, of any significance, for in 1 case 60 grains expelled only 1 worm, while in one course of treatment 25 grains expelled 2,246 worms (an average of 89.8 worms per grain of thymol).

CONCLUSIONS.

The general conclusions from the foregoing study seem to be:

(1) The present more or less frequently expressed desire to increase the dose of thymol considerably in excess of the present generally accepted maximal doses is not entirely unnatural, in view of the fact that so many patients fail to follow out the treatment until all the worms are expelled, and therefore a considerable number of persons continue to distribute the infection.

(2) Many cases of hookworm infection are cured by less than one maximal dose for the age group in question.

(3) When the thymol treatment is properly carried out, namely, when it is given under proper precautions, and the margin of safety to the patient is properly safeguarded, the present maximal doses seem to be entirely safe.

(4) The fact can not, however, be ignored that many of our patients are ignorant and illiterate, and can not be relied upon to carry out directions, and if the thymol dose in home treatment is in general increased this must be done with a distinct risk that involves a totally unnecessary danger to a large number of patients who may be completely cured with less than the present maximal dose.

(5) In view of the fact that not less than 11 deaths have occurred in the United States because of following thymol with castor oil instead of with salts or because of carelessness on the part of the patient or his family, we do not consider it wise to have a general increase in the size of the dose of thymol in the home-treatment cases. We entirely concur with the field men who in clinic practice cut the doses down below the present accepted maximal dosage.

(6) With an increase of sanitary privies, or with a repetition of smaller doses, the same eventual curative result will be obtained as would follow with an increased single dose of thymol; and while the former plan will take a longer time, it involves less risk and the improved sanitation will give additional results in other diseases.